Watervliet Arsenal
S. Broadway on the Hudson River
Watervliet
Albany County
New York

HAER No. NY-1A

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WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record

HAER,
NY,
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HISTORIC AMERICAN ENGINEERING RECORD

Watervliet Arsenal

NY-1A

Location:	S. Broadway, on the Hudson River Watervliet, Albany County, New York
Date of Construction:	Begun 1813
Present Owner	Department of the Army
Original Use:	Arsenal
Present Use:	Arsenal
Significance:	Though the War of 1812 stimulated its establishment, Watervliet Arsenal's busiest years occurred during the Mexican and Civil Wars. In 1889, it became the government's cannon factory, famous for its production of large caliber seacoast defense guns.

The history of the Nation's armed forces is part of the explanation of how America became a world power. The Army's arsenals thus possess a great significance. Of outstanding importance is the Watervliet Arsenal in Watervliet, New York.

Watervliet Arsenal was established during the War of 1812. Land was purchased on July 14, 1813, and construction of buildings began shortly after that. Additional land purchases were made in 1826, 1828, 1833, 1859, 1862, 1867, 1869, 1918, 1920, and 1942. The arsenal now comprises approximately 160 acres.

The location of the arsenal was a primary factor in determining its growth. Transportation routes, essential for the movement of military goods, were readily accessible to the arsenal. The Hudson River provided the first means of transportation, followed by the Erie and Champlain Canals, the railways, and more recently, the interstate highways. Another important factor in the choice of location was the existence of a deep underlying strata of shale bedrock that provided a perfect natural foundation for the buildings and heavy machinery used at the arsenal.

Construction at the Watervliet Arsenal can be assigned to several different periods of growth:

1813-1830: A stone arsenal and additional shops were erected.

1839-1850: The Commanding Officer's quarters, a brick laboratory, a brick paint shop, a brick stable, two stone quarters for officers, a stone barracks for soldiers, a magazine for ammunition, and two brick timber stores (buildings #14 and #105) were erected.

1860-1867: Shops and stores were extended to meet the requirements of the Civil War.

1887-1892: The Army gun factory was started.

1917-1920: Expansions to meet the demands of World War I took place.

1941-1944: Extensions and expansions to meet the needs of World War II took place.

In 1887, the Board of Ordnance Officers recommended that Watervliet Arsenal be selected as the government's cannon factory, and in 1888 a Gun Factory Board undertook a study of cannon manufacture. After the report of the board in 1889, the cannon factory was begun.

The production of seacoast cannon began in July 1889. Nine years later, the factory began work on America's first 16-inch gun, which was completed in June 1902. Although large cannons had been made in Europe, the American cannon outperformed all rivals. Before the first world war, Watervliet also produced a number of 14-inch seacoast cannons for the defenses at the Panama Canal and Manila Bay.

Addendum to
Watervliet Arsenal
S. Broadway on the Hudson River
Watervliet
Albany County
New York

HAER No. NY-1A

PHOTOGRAPHS

REDUCED COPIES OF MEASURED DRAWINGS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, D.C. 20013-7127

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HISTORIC AMERICAN ENGINEERING RECORD

Addendum to
WATERVLIET ARSENAL
HAER No. NY-1A

Location:	S. Broadway on the Hudson River, Watervliet, Albany County, New York UTM: 18.605720.4730245 Quad: Troy South
Date of Construction:	1813-Present.
Present Owner and Occupant:	U.S. Army.
Present Use:	Manufacture of gun tubes; research and development of improved weapons systems and production processes.
Significance:	Watervliet Arsenal has been in continuous operation since it was established during the War of 1812 to manufacture fixed ammunition and related accessory equipment. The arsenal's activity soon expanded to include the manufacture and repair of infantry accoutrements and gun carriages, and the repair, maintenance, and storage of small arms. In 1887 Watervliet was designated the Army's gun factory for the production of field and siege and seacoast guns. During World Wars I and II and the Korean and Vietnam Wars, the arsenal produced large quantities of weapons. Watervliet was designated a National Historic Landmark in 1967 for the important role it played in the history of the United States military.
Historian:	Barbara E. Hightower, February 1985.

Site Selection and Initial Development 1813-1823

When the United States declared war on Great Britain in June 1812, the Army's newly created Ordnance Department was charged with supplying munitions to troops and fortifications along the Atlantic seaboard and the western frontier. Colonel Decius Wadsworth, the Commiasary-General of the fledgling department, chose three major locations for ordnance production. His plan, subsequently approved by the War Department, provided for a foundry outside the nation's capital for casting cannon, mortars, and howitzers; an arsenal in Pennsylvania for manufacturing gun carriages; and a principal establishment in Albany, New York "for making fixed ammunition and all the small articles of equipment for a train of artillery."[1]

On July 14, 1813, the United States acquired a site in the Albany vicinity. A tract of approximately 12 acres in the small village of Gibbonsville directly across the Hudson River from Troy, was purchased from James Gibbons and his wife for $2,585.[2] Its location was strategically important because supplies could be transported along the Hudson and Mohawk Rivers to American defenses on the Canadian border and in New York City.[3] Its proximity to the river was also advantageous since lengthy portages of equipment over land were eliminated.

Construction proceeded rapidly, with ten buildings completed by the end of the year. Eight of the buildings--an arsenal, the commandant's quarters, a barracks and hospital, a combination office, paint shop, and commissary store, two assistant officers' quarters, and two enlisted mens' quarters--were built around a parade and drill ground known as the "yard." Two small stables were constructed nearby. Between 1815 and 1817, two timber sheds, three gun houses, a gun saluting ahed, and a small laboratory were added west of the yard. None of these structures, which occupied the northeast corner of the present arsenal grounds, now survive.[4]

During the War of 1812, Watervliet, along with additional arsenals and depots at Buffalo, Batavia, and Rome, New York and Vergennes, Vermont, waa placed under the command of Major James Dalliba. Since Dalliba was stationed at Buffalo during the war, the araenal's temporary commandant, Captain Thomas L. Campbell (1813-1816), oversaw the initial conatruction and operation of Watervliet. In November 1816, Dalliba took full command of the arsenal and remained there until his retirement in May 1824. Little conatruction occurred during these years despite Dalliba's complaints about inadequate facilities.[5] Conaequently, production activities at Watervliet, which included the manufacture and repair of infantry accoutrements, artillery equipment, ammunition, and gun carriages, and the repair, maintenance, and storage of small arms, were limited.[6]

Arsenal Expansion 1824-1886

Brevet Major George Talcott assumed command of the arsenal in late 1824 and immediately requested appropriations for expansion of its grounds and facilities. Citing crowded conditions, the growth of neighboring communities, and escalating land prices, Talcott urged the purchase of "such an extent of ground as will suffice for all future improvements..."[7] He further noted that appropriations were necessary for the erection of storage buildings.[8] Construction of these buildings began shortly thereafter, but no land was acquired until 1828, when 30 acres to the south and west were purchased.[9] Two more tracts totalling 45 acres were added five years later.

During the ten years that Talcott served as commander, about a dozen buildings were constructed at the arsenal, primarily on the tract purchased in 1828. The largest, a two-story stone arsenal with prominent tower, was built in 1826-27 in the present housing area. This imposing structure, which had a capacity of "about 140,000 muskets in boxes or 100,000 in racks," was demolished in 1889.[10] The "east magazine" (HAER No. NY-1D, Building 119), a massive limestone structure with brick columns supporting a vaulted ceiling, was erected at some distance from the arsenal's other buildings in 1828. A new manufacturing area was developed south of the yard in 1828 and 1830 with the construction of a smith and foundry shop, carpenter shop, coal house, and sawmill.[11] Additional construction included temporary storage sheds, a magazine keeper's house, and lumber and nitre (HAER No. NY-1F, Building 17) storehouses.

The State of New York laid the Erie Canal across the Watervliet grounds in the early 1820s, but a decade passed before the arsenal utilized the canal for purposes other than shipping. In 1830 and again in 1831, Talcott requested use of "a portion of the surplus waters of the...Canal for hydraulic purposes."[12] He justified this request by stating that the arsenal's operations had "for their chief object the preparations and preservation of the means of defense for the State and the arming of its Militia."[13] Permission was finally granted in 1833, allowing the arsenal to switch its source of motive power from horses to water.[14] The canal provided power for Watervliet's shops until about the time the state abandoned the waterway in 1922.[15] Portions of the walls built along the canal in the early 1830s are the only vestiges marking its path acoss the arsenal grounds.

When Major Rufus L. Baker took command of the arsenal in 1838, many of its buildings had either deteriorated or were too small for current production needs.[16] He proposed an ambitious construction program that resulted in the erection of 18 new buildings and the demolition of at least 12 others, most of which had been built prior to 1817.[17]

Baker's construction program commenced shortly after his arrival at Watervliet and continued through the 1840s (see HAER Photo No. NY-1A-79). The Commandant's quarters (HABS No. NY-5521B, Building 1) was built in 1841.

Judging from his correspondence, Baker took part in the design of this imposing Greek revival stone house. A double set of officers' quarters (HABS No. NY-5521C, Building 6) was planned at the same time but was not built until the end of the decade.[18] Erected north of the arsenal building, the house is similar in design and material to the Commandant's quarters. A third stone structure, an enlisted barracks (HABS No. NY-5521G, Building 24), was built in 1843 west of the canal.

Manufacturing and storage facilities were also expanded. Two one-story brick structures, known as the north (HAER No. NY-1I, Building 15) and south (HAER No. NY-1H, Building 22) carriage stores, were built west of the nitre storehouse in 1839.[19] A powder laboratory (HAER No. NY-1G, Building 41), with piazzas on its east and west sides designed to "exclude storms and the sun, and furnish a shelter for stores during their receipt or delivery," went up adjacent to the canal in 1840.[20] An addition to house the manufacture of gun carriages was made to the reconstructed smith and foundry shop (HAER No. NY-1C, Building 40) by the early 1840s, and a finishing shop was added to the building in 1847. The "west magazine" (HAER No. NY-1E, Building 129), similar to the "east magazine," was erected at the far west corner of the site in 1849. Several smaller magazines, stables, and storehouses were also constructed during Baker's tenure but all have been demolished.[21]

Construction continued over the next two decades, although at a slower rate, under the commands of Major John Symington (1851-1857), Major Alfred Mordecai (1857-1861), Colonel William A. Thornton (1861-1863), and Brigadier General Peter V. Hagner (1863-1880) (see HAER Photo No. NY-1A-80). An enlisted mens' cottage was built of brick in 1861, and a hospital (Building 19) was added in 1864. Three years later, a duplex officers' quarters (HABS No. NY-5521D, Building 4) was erected near the stone officers' residences at the north side of the arsenal. Most other structures built during these decades, including offices, storehouses, an octagonal guardhouse, and enlisted mens' quarters, have been demolished.[22]

Facilities in the manufacturing area were expanded in 1859 and 1865 with the construction of two architecturally distinctive buildings. Shortly after Mordecai's arrival at Watervliet in 1857, he requested a new storehouse since it was often "necessary to expedite large orders for gun carriages which [were] not to be kept long on hand."[23] Two years later, a contract was made with Architectural Iron Works of New York City for a Renaissance revival style structure built of cast-iron components that were cast in New York City and assembled on a recently acquired site south of the arsenal's shops (HAER No. NY-1, Building 38). An L-shaped fireproof storehouse and shops structure with an engine room (HAER No. NY-1C, Building 40) was completed north of the cast-iron storehouse in 1865. Adjoining the recently enlarged finishing shop on the east, this two-story building, known as the Broadway shops, has classical detailing with regularly spaced pilasters and pedimented gable ends.[24]

The amount and variety of materiel produced at Watervliet increased with expansion of its facilities and the outbreak of war. At the end of the 1830s, emphasis had shifted to the manufacture of carriages for large guns. Several years later, the arsenal added harnesses, saddles, and bridles to its line of products.[25] The Mexican War of 1845-1848 quickened the pace at Watervliet. Employment nearly doubled, and manufacturing of gun carriages and infantry accoutrements increased. The production of cartridges for muskets, rifles, carbines, pistols, and flint and percussion arms averaged over one million every two weeks, and additional ammunition was procured from private manufacturers for distribution by the arsenal.[26] Following ratification of the peace treaty in 1848, Watervliet was inundated with supplies returned from the battlefield, making its immediate priority one of repair and storage.

In the decade before the Civil War, the arsenal's shops were occupied with converting small arms from flint to percussion firing, as well as manufacturing new types of gun carriages and ammunition. Construction of the "prairie carriage," developed by Major Baker, began by 1850. Lighter than earlier models and painted a cream color to reflect the sun, the carriage was designed for use on the plains and deserts of the western United States.[27] Another improvement in gun carriage production was implemented in the late 1850s, when the arsenal started producing seacoast gun carriages of wrought iron instead of timber.[28] Ammunition output at Watervliet also increased in the late 1850s, when the foreman of the machine shop developed an improved bullet press that enabled the arsenal to nearly triple bullet production.[29]

Overall production climbed to an unparalleled height with the onset of the Civil War. In a 1920 history of the arsenal, Francis K. Kyle described Watervliet during these years:

> ...the amount of business at Watervliet Arsenal was doubled, trebled and quadrupled until about 2000 employees were on the rolls. Thousands of gun carriages were made, thousands of barrels of powder were ordered from Schaghticoke, tons of lead were molded into bullets and tons of shot and shells were made or contracted for. In addition leather equipment, horse brushes, etc., were made, bought and distributed. Cartridges for small arms were made by the million. In fact the Arsenal expanded as a distributing point and as a manufacturer of ammunitions and its activities have been exceeded since only during the recent world war.[30]

The post-war years brought decline to Watervliet. Production and employment dropped, and the arsenal was once again charged with the repair and storage of returned materiel and the disposal of surplus property. Faced with a sagging economy during the 1870s, Congress appropriated only small amounts for the operation of Watervliet, and the possibility of selling the arsenal was briefly considered.[31]

The Army's Gun Factory

Events in the 1880s ushered in a new era for the arsenal. Changing gun technology, and the economy and efficiency gained by producing heavy caliber weaponry at only one or two locations, led President Chester A. Arthur to appoint a board of Army and Navy officers in 1883. The board was charged with determining which navy yard or arsenal was best suited for a government factory that would "manufacture...heavy ordnance adapted to modern warfare."[32] Muzzle loading cannon, which could be easily cast, was outdated. Manufacture of the newer breech-loading cannon developed after the Civil War was more complicated, and research was required to improve the effectiveness of these guns. Only the federal government had the resources to perform this research and to produce the guns.[33]

A number of Army arsenals, including Watervliet, were investigated by the board but none was chosen.[34] In 1887 a second board was instructed to evaluate both Watervliet and Frankford Arsenals on the basis of:

> ...the character and extent of the shops and appliances that would be required, from buildings already erected at either point, from the proximity of the place to the establishments that will probably furnish the material to be worked, its security against hostile operations, its facilities as regards transportation of material and guns, both by water and rail, its proximity to the centers of skilled labor, manufacturers' supplies and fuel.[35]

The board decided in favor of Watervliet, finding that the arsenal offered "better advantages...for the effective and speedy establishment of a gun plant sufficient for immediate wants."[36] A two-story brick structure was converted for manufacture of 3.2-, 8-, and 10-inch breech-loading steel guns. Machinery and tools were transferred from other arsenals, and production in the field and siege gunshop was underway by October. (This gunshop, constructed in 1845 as a storehouse for timber, was demolished in 1982 as part of Project REARM, the arsenal's current modernization program.)

Congress appropriated funds in September 1888 for the construction of a second shop to produce large seacoast guns (HAER No. NY-1B, Building 110). Construction began the following year on the north wing and central section. The south wing was added in 1891-1892 to accommodate production of the larger 16-inch guns. Shortly before the south wing was completed, the Ordnance Department began acquiring machinery to equip it. But seven years passed before production of the first 16-inch cannon got underway, and four more years went by before it left the shop for testing at Sandy Hook Proving Ground.

The arsenal's gun factory experienced its first stint of war-time production during the Spanish-American War. When the American battleship "Maine" was sunk in Cuban waters on February 15, 1898, the gun factory, which had been

operating below capacity during the mid-1890s, was immediately ordered to boost production. Handicapped by a paucity of highly skilled machinists, Colonel Alfred Mordecai, the arsenal's commander, increased output by hiring a larger work force and adding night shifts. Work was stepped up in the Broadway shops where armament chests (containers for holding seacoast cannon ammunition) were manufactured. During this period, the arsenal also manufactured cartridges, cartridge bags, and seacoast projectiles.[37]

After the turn of the century, the gun factory continued to make conventional weapons on a limited basis. It also expanded its operations into new areas. Beginning in 1906, large seacoast guns, whose linings had been worn by usage, were shipped to the arsenal where the linings were replaced. Heating the gun and cooling the innermost tube simultaneously caused the lining to shrink and allowed its removal from the remainder of the gun.[38] In 1910 Watervliet also produced a new type of weapon--the country's first "balloon gun," a 6-pound, 2.24-inch caliber gun--to thwart attack by dirigibles and airplanes.[39]

Although work at the arsenal concentrated on the production of guns, the older shops east of the canal remained in operation. During the 1890s, the machine, carpenter, and blacksmith shops manufactured field caissons and limbers (a two-wheeled vehicle to which guns or caissons are attached), battery wagons with forges, armament chests, and artillery, infantry, and cavalry equipment. By 1900 production was mostly limited to armament chests and spare parts for seacoast and rapid-fire guns. The cast-iron storehouse, because of its proximity to the shops, was converted in 1889 to a foundry for casting projectiles.[40] Work on heavier projectiles was transferred to Watertown Arsenal around 1893, and the foundry was closed the following year.

Establishment of the Army's gun factory at the arsenal required a variety of additional facilities (See HAER Photo No. NY-1A-81). Rail lines were extended across the grounds from the Delaware and Hudson Canal Company's line on the west, and a wrought-iron railway bridge (now demolished) was built over the canal in 1894.[41] Two assistant officers quarters (HABS No. NY-5521E, Building 2 and HABS No. NY-5521F, Building 3) were completed in December 1889.[42] The two Queen Anne structures are located west of the stone quarters built in the 1840s. A house (Building 8) was added for the shop's master mechanic in 1890 An electric lighting and power plant was built in 1894, and a two-story brick building (HABS No. NY-5521A, Building 10) housing the arsenal's administrative offices was completed in the same year. Roads and the water and sewer systems were also improved during this period, and the water power plant serving the shops east of the canal was refurbished.

Almost no construction took place in the two decades preceding World War I. A two-story annex, built of brick salvaged from demolition of the arsenal's old office building, was added to the hospital in 1902. A greenhouse (HABS No. NY-5521H, Building 12), used to grow the plants that ornamented the arsenal's grounds, was built in 1903 to replace an earlier dilapidated greenhouse.[43]

World War I

America's entry into World War I occasioned an unprecedented expansion of the arsenal's facilities. In an annual report made to the Ordnance Department in mid-1918, Watervliet's commander, Lt. Colonel J. E. Munroe, explained this change:

> The salient feature of the past year's history of the arsenal has been the change of the manufacturing plant from what was virtually a jobbing shop to a works designed for quantity production...This development has involved the construction of new shop buildings, considerably exceeding in size the aggregate of those heretofore utilized; their equipment with modern machine tools; the provision of jigs, fixtures, gauges and other manufacturing appliances suited for repetition work; the design and procurement of inspection gauges; many auxiliary and incidental undertakings and the accumulation of personnel for operating the new shops.[44]

In 1918 two manufacturing complexes were built by Fred T. Ley & Co. (see HAER Photo No. NY-1A-83). One, constructed east of the seacoast gun shop, contained a gun shop (Building 35) with a daily production capacity of four 240 mm. howitzers and two 155 mm. guns; a mobile artillery shop (Building 25);[45] a storehouse (Building 23); a tool room; and a carpenter shop. The second complex--a liner shop (Building 125), forge and blacksmith shop (Building 126), brass foundry (Building 123), wood reamer shop (Building 122), and boiler house (Building 124)--was erected west of the seacoast gun shop.

Additional facilities were constructed or enlarged primarily to accommodate the increased number of personnel and supplies required for war-time production. Cantonment buildings, including barracks, mess halls, a canteen, and officers' quarters, were erected north of the mobile artillery shop. These one-story wood frame structures have all been demolished. The brick cottage built in 1861 to house enlisted personnel was demolished to make way for a storehouse, and most of its bricks and woodwork were used to rebuild the quarters (Building 9) north of the hospital.[46] The quartermaster storehouse (HAER No. NY-1H, Building 22) was enlarged, and two one-story brick structures housing the cafeteria (Building 21) and fire house (Building 18) were built nearby. A third story was added to the arsenal's headquarters (HABS No. NY-5521A, Building 10), and two new wings were constructed on the building's north side.

Gun production began to climb even before the United States entered the war. More guns were completed in the year ending in mid-1915 than in any previous year.[47] Production dipped in 1916 but began a steady climb the following year. Total war-time production amounted to 1,066 new guns of all calibers, 187 guns and howitzers modified or relined, and 161,662 spare parts.[48] The increase in employment kept pace with production, rising from 670 in June 1917 to 3,361 a year later.[49]

War-time work at Watervliet was not limited to gun manufacture. A supply depot overhauled and cleaned nearly 100,000 Krag rifles and carbines, and issued targets and personnel and horse equipment.[50] The arsenal also operated four schools: a cannon relining school to train personnel to operate an ordnance depot in France; a supply school for officers; an apprentice school for machinists; and a school that trained civilians to inspect the steel used in cannon and artillery ammunition.[51]

The frenzy of activity subsided at war's end. Employment dropped rapidly, and unfilled orders were reduced or cancelled. However, Watervliet maintained an important position in gun manufacture, at least initially. The Ordnance Department designated the arsenal:

> ...as the plant to superintend the final stages of all types of cannon and to modify and perfect their designs in accordance with the results of proofs and tests and to provide the necessary jigs, fixtures and machines for the manufacture of the adopted designs and, generally, under instructions from the Chief of Ordnance and the General Staff, to act as the center for cannon industry and as the mainstay of the country for the production of cannon in time of war, including putting into prompt operation all gun plants held in ordinary as well as of the private plants which it would be necessary to instruct and equip.[52]

Despite this designation, the arsenal went through a slump during the next two decades. By the early 1920s, manufacturing activities were limited to a single wing of the seacoast gun shop, causing Watervliet's commander Colonel Edwin D. Bricker to complain: "It is believed that the danger point has been reached, that any further drastic reduction in personnel at this establishment will have the effect of destroying the gun-making industry as far as the Army is concerned."[53] Many of the arsenal's manufacturing buildings, placed on standby in the early 1920s, fell into disrepair due to limited maintenance funds.[54]

In the 1930s federal assistance programs offered some relief from these conditions. A naval construction program, funded by the Public Works Administration, brought a brief upturn in production; part of the heavy field cannon shop (Building 35) was opened to make fifty 5-inch antiaircraft guns and to reline 4-inch guns. Twelve 105 mm. antiaircraft guns were constructed for the Army at the same time. The Civil Works Administration and the Works Progress Administration funded some repairs to the arsenal's buildings.[55]

World War II

Watervliet was jolted into activity in 1939 after Hitler invaded Poland. Three years later, as the arsenal reached an all-time peak in gun production, its engineering officer, Colonel Steven L. Conner, described the

installation's rebirth:

> ...the Arsenal itself is a roaring hive of activity. While the men from industry were preparing to produce, the Arsenal itself began to grow. Working under pressure, whole buildings filled with specialized gun-making machinery which was left over from the war of 1918, were cleared. Hundreds of carloads of machines were sent out to initiate the equipment in the plants of private manufacturers. Hundreds of machines, both old and new, were installed in the Arsenal shops. Employment rose by leaps and bounds. The hard core of foremen and master mechanics in whom the art of building American cannon rests, worked day and night planning, training men, and building up their operating forces. The curve of production rose steadily until now a year's production of four years ago, is made in less than a day. New methods, new machines, and old machines are producing cannon of all sizes from the powerful little 37 mm. to the mighty 16-inch rifle at a rate many, many times that ever before seen in America.[56]

Although private manufacturers were building weaponry with the assistance of the arsenal, Watervliet was the country's single largest producer of guns,[57] and the only one capable of manufacturing Army cannon larger than 155 mm. Initially, work concentrsted on smaller weapons such as the 37 and 75 mm. guns installed on tanks, antitank vehicles, and airplanes.[58] Construction of larger mobile artillery became paramount in 1943 as preparations were made for the invasion of Europe. The 155 mm. cannon was foremost among the heavy artillery produced at the arsenal during the last two years of the war. This gun, known as "Long Tom," could be easily transported by truck and was capable of firing 155 mm. shells up to 14 miles. An 8-inch gun, with a range of 20 miles, and the highly destructive 240 mm. howitzer were also manufactured in Watervliet's shops. New methods of cleaning and painting guns and improvements in coldworking and machinery sped production.[59]

Additionsl buildings were needed to meet the demands of war-time production and storage. By this time, little vacant land remained within the arsenal's boundaries, and two tracts totalling about 20 acres were acquired in 1942. A warehouse (Building 145) wss built on the northwest plot. Called "Siberia" because of its isolated locstion and the lack of heat during winter, this concrete block structure added nearly 127,000 square feet of storage spsce. A building for the production of large caliber weapons (HAER No. NY-1J, Building 135) went up on the southern tract in 1942-43. Built of brick and large expanses of corrugated glass, the structure contained shrink pits and a 10,000,000 pound coldworking press.[60] A smaller manufacturing facility (Building 20) designed for production of 4.5-inch guns was completed in 1941 north of the World War I liner shop. Tank repair and reconditioning work took place in two brick structures (Buildings 114 and 115) built in 1942. A warehouse (Building 120), a proof firing and testing building, and a heating plant (Building 136) were also added, and a number of the arsenal's

facilities, including the headquarters (HABS No. NY-5521A, Building 10), Broadway shops (HAER No. NY-1C, Building 40), and seacoast gun shop (HAER No. NY-1B, Building 110) were enlarged.

The transition to peacetime activity after V-J day resembled the sequence of events at the close of earlier wars. Employment and production figures dropped. Only one manufacturing building (Building 20) remained in operation,[61] and most remaining shops were converted to other uses or placed on standby. The arsenal was inundated with returned materiel including machinery from civilian gun manufacturers.

Korean War to the Present

The post-war decline began a reversal in 1947 with a slight rise in production figures. At the same time, the arsenal again began to procure weapons from civilian manufacturers, a practice dropped almost entirely at war's end. On the eve of the Korean War, Watervliet was mainly a prototype manufacturer, and much of its role as the nation's Army gun factory had been transferred to private industry.[62] During the war, weapons produced at Watervliet equalled only 14% of those made by private industry.[63]

Work picked up considerably during the Vietnam War, concentrating on heavy weapons, particularly the 175 mm. M113 gun. In late 1970 the arsenal cancelled orders to private manufacturers and again became the only active cannon producer in the country.[64] At war's end, Watervliet turned to the production of guns to arm the increased number of tanks built by the Army. The 1970s also saw the design and manufacture of a series of weapons such as the 8-inch M201 gun-howitzer, the Army's most powerful conventional weapon.[65]

The arsenal had been assigned responsibility for furthering the research and development of gun manufacture in 1947. Over the ensuing decades, this research was directed toward improving recoilless rifles and aircraft, anti-aircraft, and tank weapons; designing a series of self-propelled artillery weapons and mortars; development of atomic weaponry and missiles; and upgrading production processes and materials, including precision shrinking by induction heating, chrome plating, gun drilling, expanded precision casting, and electronic telltaling and sensing.[66] Since 1962, this work has been conducted by the Benet Research and Engineering Laboratories at Watervliet.

With few exceptions through the late 1970s, post-World War II construction consisted of only a small number of storage structures. A building designed to house final inspection gauges and temperature and humidity controlled experimental laboratories (Dalliba Hall, Building 44) was completed in 1956 and enlarged in 1977 to accommodate simulation testing facilities. A water pollution control plant (Building 356) was added in 1970. Project REARM, approved by Congress in August 1978, brought significant changes to Watervliet, however. Under this modernization program 19 obsolete buildings,

including the former field and siege gun shop, were demolished, and Building 35 was considerably enlarged to provide facilities for medium caliber gun tube manufacturing and heat treating, plating, and supply operations.[67]

NOTES

1. Colonel Decius Wadsworth to Secretary of War, Honorable John Armstrong, November 13, 1812 as quoted in Francis K. Kyle, A History of Watervliet Arsenal (Watervliet, New York: Watervliet Arsenal, June 30, 1920), pp. 20-21; A History of Watervliet Arsenal, 1813 to Modernization 1982 (Watervliet, New York: U.S. Army Watervliet Arsenal, n.d.), pp. 1-2.

2. Kyle, p. 20. The arsenal was originally referred to as the arsenal at Gibbonsville or as the one near Troy. By 1817 the arsenal and the surrounding area became known by the Dutch name Watervliet, meaning flood tide or rolling water, because of frequent spring flooding. The villages of Watervliet, Port Schuyler, Gibbonsville, and Washington to the south of the arsenal were later combined and designated West Troy. West Troy was incorporated in 1897 and renamed Watervliet. A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 2.

3. Wadsworth to Armstrong, November 13, 1812 as quoted in Kyle, pp. 20-21; A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 1.

4. A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 2. Building uses and dates of construction and demolition are listed in Kyle, pp. 7-8.

5. A History of Watervliet Arsenal, 1813 to Modernization 1982, pp. 10-11.

6. Ibid, pp. 6, 9, 13.

7. Brevet Major George Talcott to Lt. Colonel George Bomford, March 28, 1825 and April 12, 1825 as quoted in Kyle, pp. 55-58.

8. Ibid.

9. F. J. Stephenson, "Historical Sketch of Watervliet Arsenal" (Watervliet, New York: Watervliet Arsenal, July 1, 1910), p. 2. Record Group 156; Records of the Chief of Ordnance, Entry 30025-D, Subentry 227, Navy and Old Army Division, National Archives, Washington, D.C.

10. Brevet Major George Talcott to Colonel George Bomford, March 21, 1827 as quoted in Kyle, pp. 58-59.

11. The smith shop burned in 1840 and was rebuilt on the same site shortly afterwards. Major Rufus L. Baker to Colonel George Talcott, May 17, 1840 as quoted in Kyle, pp. 93-94. See also A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 19.

12. Brevet Major George Talcott to His Excellency Governor Throop, February 6, 1830 as quoted in Kyle, pp. 71-72; Brevet Major George Talcott to His Excellency Governor Throop, February 21, 1831 as quoted in Stephenson, pp. 28-29.

13. Talcott to Throop, February 6, 1830 as quoted in Kyle, p. 72.

14. Resolution of the Board of Canal Commissioners of the State of New York, passed April 16, 1833 as quoted in Stephenson, pp. 29-30.

15. During the winter of 1839-1840, the canal was closed, drained, and deepened, depriving the arsenal's shops of their source of power. An eight-horsepower steam engine was obtained to provide power during work on the canal. The canal was closed intermittently in later years, and steam engines were used for powering the machinery. See for example A History of Watervliet Arsenal, 1813 to Modernization 1982, pp. 18, 20, 24, 35, 57.

16. Major Rufus L. Baker to Lt. Colonel George Talcott, April 6, 1839 as quoted in Kyle, p. 93.

17. Ibid, pp. 88-93.

18. Baker to Bomford, May 26, 1841 as quoted in Kyle, p. 99.

19. See Major Rufus L. Baker to Colonel George Bomford, May 10, 1841 as quoted in Kyle, p. 97. The north carriage storehouse was moved to its current site in the 1890s (Kyle, p. 9).

20. Baker to Talcott, April 6, 1839 as quoted in Kyle, p. 90.

21. For dates of construction and demolition, see Kyle, pp. 9-10.

22. For demolition dates, see Kyle, pp. 10-11.

23. Major Alfred Mordecai to Colonel H. K. Craig, July 10, 1857 as quoted in Selma Thomas, "Cast-Iron Storehouse 1859, Watervliet Arsenal, Watervliet (HAER NY-1)" in A Report of the Mohawk-Hudson Area Survey: A Selective Recording Survey of the Industrial Archeology of the Mohawk and Hudson River Valleys in the Vicinity of Troy, New York, June-September 1969, ed. Robert M. Vogel (Washington, D.C.: Smithsonian Institution Press, 1973), p. 26.

24. Similar classical detailing and projecting pavilions along the front facade appear on shops structures built at Watertown Arsenal in 1862 and at Rock Island Arsenal in the 1870s and 1880s. The Watertown shop building was designed by General Thomas J. Rodman and may have provided a model for Watervliet's Building 40. Rodman also designed the shops at Rock Island.

25. A History of Watervliet Arsenal, 1813 to Modernization 1982, pp. 18, 20. The gun carriages built at the arsenal were primarily wooden; cast iron had been used but was found to break easily in cold weather. Experiments to toughen and strengthen the wood in order to prevent decay by soaking it in mineral solutions began in 1840. After four years, the attempts proved unsuccessful, and the experiments were discontinued. Ibid, pp. 19-20.

26. Ibid, pp. 25-26.

27. Ibid, p. 31.

28. Emanuel Raymond Lewis, Seacoast Fortifications of the United States, An Introductory History (Annapolis, Maryland: Leeward Publications Inc., 1979), p. 65; Vogel, p. 26.

29. A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 33. See also Major Alfred Mordecai to Colonel H. K. Craig, March 23, 1859 as quoted in Kyle, pp. 193-194.

30. Kyle, p. 209. For a more detailed discussion of the arsenal during the Civil War, see A History of Watervliet Arsenal, 1813 to Modernization 1982, pp. 37-39, 56-63.

31. For example see U.S., Congress, House, Report of the Secretary of War, vol. 1635, 1874, pp. 258-259; U.S., Congress, House, Report of the Secretary of War, vol. 1677, 1875, pp. 19-25; U.S., Congress, House, Report of the Secretary of War, vol. 1746, 1876, p. 4-5.

32. A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 74.

33. Ibid; See also U.S., Congress, House, Report of the Secretary of War, vol. 2538, 1887, pp. 18-19.

34. The Board appointed in 1883 recommended establishment of both Navy and Army gun factories. Funds were appropriated in 1886 for the Navy's factory located at the Washington Navy Yard. Annual Report of the Secretary of War for the Year 1890, vol. 3, Ordnance (Washington, D.C.: Government Printing Office, 1890), p. 12.

35. U.S., Congress, House, Report of the Secretary of War, vol. 2538, 1887, p. 20.

36. More specifically, the Board found that: "...in all matters except the following, there is no decided superiority in one of these arsenals over the other. Watervliet provides excellent foundations, whereas Frankford does not; firing facilities can be obtained at Watervliet but not at Frankford, the former has better facilities for labor, and its water connection with the northern frontier is of importance; but its great and important advantages over Frankford are that the immediate concentration of the Department gun plant can be there effected more cheaply, that it has larger and better buildings and more ground for immediate expansion, and that unoccupied adjacent lands furnish the possibility of extension in the distant future into so great an establishment as the future wants of the country may demand." Ibid, p. 21.

37. A History of Watervliet Arsenal, 1813 to Modernization 1982, pp. 83-84.

38. The replacement process required deepening the shrinkage pit in the large seacoast gun shop to 90 feet. Ibid, p. 94.

39. General William Crozier, the Chief of Ordnance, explained the need for production of the balloon gun: "the attack of dirigible balloons and aeroplanes, of which the use in future wars, at least for purposes of observation, is highly probable...The subject is yet in its infancy, but the difficulty of successful attack against such machines is readily apparent. They move rapidly, change direction quickly, alter their elevations at will, and are removed from any objects that assist in aiming." Ibid, p. 95.

40. See Colonel J. M. Whittemore to Chief of Ordnance, November 10, 1888 and July 31, 1889 as quoted in Kyle, pp. 381-382, 391.

41. U.S., Congress, House, Report of the Secretary of War, vol. 2720, 1889, p. 344.

42. See Colonel J. M. Whittemore to Chief of Ordnance, April 25, 1888, March 12, 1889, and October 22, 1889 as quoted in Kyle, pp. 376, 387, 392.

43. Colonel J. P. Farley to Chief of Ordnance, July 5, 1902 as quoted in Kyle, pp. 556-558.

44. Annual Report for Watervliet Arsenal for the Year ended June 30, 1918 as quoted in Kyle, p. 610.

45. See Completion Report of Buildings Constructed by the Construction Division of the U.S. Army at Watervliet Arsenal Watervliet, N.Y., May to December 1918 (n. pl.: n. pub., n.d.).

46. Ibid, pp. 9-10.

47. Annual Report for Watervliet Arsenal for the Year Ended June 30, 1915 as quoted in Kyle, p. 588.

48. A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 102.

49. Annual Report for Watervliet Arsenal for the Year Ended June 30, 1918 as quoted in Kyle, p. 610.

50. Kyle, p. 605; A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 101.

51. A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 100.

52. Annual Report for Watervliet Arsenal for the Year Ended June 30, 1919 as quoted in Kyle, p. 620. As a result of the designation, gun manufacturing equipment was stockpiled, and improvements were made to the seacoast gun shop. The shop's south wing was extended in 1920. Its shrinkage pit was enlarged, and an electric furnace replaced the pit's oil-burning furnace. Facilities for production of 18-inch, 50 caliber guns were also planned but never built. A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 105.

53. A History of Watervliet Arsenal, 1813 to Modernization 1982, pp. 114-115.

54. Ibid, p. 115.

55. Ibid, p. 118.

56. As quoted in A History of Watervliet Arsenal, 1813 to Modernization 1982, p. 125.

57. Ibid, pp. 123, 141. During the war, Watervliet manufactured 28 different kinds of guns, howitzers, and mortars ranging in size from 37 mm. to 16-inches. Ibid, p. 138.

58. Ibid, pp. 123, 125.

59. Ibid, pp. 126, 139-140.

60. Ibid, pp. 126-127. Coldworking is a method by which "metal (is) subjected to very high hydrostatic pressure...to produce...strengthening stresses." Ibid, p. 193.

61. Ibid, p. 144.

62. Ibid, p. 158.

63. Ibid, p. 166.

64. Ibid, p. 223.

65. Ibid, p. 233.

66. See Ibid, pp. 148, 153-155, 163-164, 199.

67. Ibid, p. 240.

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February 1985

PROJECT INFORMATION

This project was part of a program initiated through a memorandum of agreement between the National Park Service and the U.S. Department of the Army. Stanley H. Fried, Chief, Real Estate Branch of Headquarters DARCOM, and Dr. Robert J. Kapsch, Chief of the Historic American Buildings Survey/Historic American Engineering Record, were program directors. Sally Kress Tompkins of

HABS/HAER was program manager, and Robie S. Lange of HABS/HAER was project manager. Under the direction of William A. Brenner, Building Technology Incorporated, Silver Spring, Maryland, acted as primary contractor, and MacDonald and Mack Partnership, Minneapolis, was a major subcontractor. The project included a survey of historic properties at Watervliet Arsenal, as well as preparation of an historic properties report and HABS/HAER documentation for 17 buildings. The survey, report, and documentation were completed by Barbara E. Hightower, historian, Minneapolis. The photographs were taken by Robert A. Ryan and J Ceronie of Dennett, Muessig, Ryan, and Associates, Ltd., Iowa City, Iowa. Drawings were produced by Gary M. Louris, Minneapolis.

For further documentation on specific structures at Watervliet Arsenal see:

Cast-Iron Storehouse	HAER No. NY-1
Seacoast Gun Shop (Building 110, Big Gun Shop)	HAER No. NY-1B
Broadway Shops (Building 40, Benet Research and Engineering Laboratories)	HAER No. NY-1C
East Magazine (Building 119)	HAER No. NY-1D
West Magazine (Building 129)	HAER No. NY-1E
Nitre Storehouse (Building 17, Roads and Grounds Shop)	HAER No. NY-1F
Powder Laboratory (Building 41, Officers' Club)	HAER No. NY-1G
South Carriage Storehouse (Building 22, Fire Station)	HAER No. NY-1H
North Carriage Storehouse (Building 15, Motor Pool Garage)	HAER No. NY-1I
Large Caliber Gun Tube Manufacturing Building (Building 135)	HAER No. NY-1J
Headquarters (Building 10, Campbell Hall)	HABS No. NY-5521A
South Stone Quarters (Quarters 1, Commandant's Quarters)	HABS No. NY-5521B
North Stone Quarters (Quarters 6, Assistant Officers' Quarters)	HABS No. NY-5521C
Officers' Quarters (Quarters 4)	HABS No. NY-5521D
Officer's Quarters (Quarters 2)	HABS No. NY-5521E
Officer's Quarters (Quarters 3)	HABS No. NY-5521F
Barracks (Building 24, Operations Directorate Office)	HABS No. NY-5521G
Greenhouse (Building 12, Community Facility)	HABS No. NY-5521H